CLAIMS

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~~1.~~ A digital equalization method for estimating discrete information symbols (d_k) from digital samples (y_k) of a signal received over a transmission channel represented by a finite impulse response of W+1 coefficients ($r_0, r_1, \ldots, r_w$), W being an integer greater than 1, comprising the step of determining the W roots ($\alpha_1, \alpha_2, \ldots, \alpha_W$) in the complex plane of the Z-transform (R(Z)) of the impulse response, characterized it further comprises the steps of:

- distributing the W roots into a first set of W-p roots ($\alpha_1, \ldots, \alpha_{W-p}$) and a second set of p roots ($\alpha_{W-p+1}, \ldots, \alpha_W$), p being an integer greater than 0 and smaller than W, the roots of the second set being closer to the unit circle than those of the first set according to a determined distance criterion in the complex plane;
- obtaining an intermediate signal (Y') by applying a first equalization method to the received signal (Y) based on a finite impulse response whose Z-transform ($R^S(Z)$), formed by a polynomial of degree W-p in Z^{-1}, has roots which are the W-p roots of the first set; and
- obtaining estimations ($\hat{d}_k$) of the discrete information symbols by applying a second equalization method to the intermediate signal based on a finite impulse response whose Z-transform ($R^I(Z)$), formed by a polynomial of degree p in Z^{-1}, has roots which are the p roots of the ~~second set.~~

2. A method according to claim 1, wherein the first equalization method yields the intermediate signal in the form of a vector Y′ of n+p samples $(y'_1, \ldots, y'_{n+p})$ obtained according to the relation :

$$Y' = (A'^H A')^{-1} A'^H Y$$

where n is an integer representing a frame size, Y is a vector composed of n+W samples (y_k) of the received signal, and A′ is a matrix with n+W rows and n+p columns having a Toeplitz structure formed from the coefficients (s_q) of said polynomial of degree W-p in Z^{-1} $(R^S(Z))$.

3. A method according to claim 1 or 2, wherein the second equalization method comprises implementing a Viterbi algorithm.

4. A method according to any one of claims 1 to 3, wherein the unit circle distance criterion, used to distribute the W roots $\alpha_1, \ldots, \alpha_W$ of the Z-transform (R(Z)) of the channel impulse response into the first and second sets, is expressed as a distance δ_q of the form $\delta_q = 1 - |\alpha_q|$ if $|\alpha_q| \le 1$, and of the form $\delta_q = 1 - 1/|\alpha_q|$ if $|\alpha_q| > 1$, for $1 \le q \le W$.

5. A radio communications receiver comprising :

- conversion means (1,3,4) to produce digital samples (y_k) from a radio signal received over a transmission channel represented by a finite impulse response of W+1 coefficients $(r_0, r_1, \ldots, r_W)$, W being an integer greater than 1;
- means (6) for measuring the channel impulse response;

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- means for calculating the W roots $(\alpha_1, \alpha_2, \ldots, \alpha_W)$ in the complex plane of the Z-transform (R(Z)) of the impulse response;
- means for distributing the W roots into a first set of W-p roots $(\alpha_1, \ldots, \alpha_{W-p})$ and a second set of p roots $(\alpha_{W-p+1}, \ldots, \alpha_W)$, p being an integer greater than 0 and smaller than W, the roots of the second set being closer to the unit circle than those of the first set according to a determined distance criterion in the complex plane;
- a first equalization stage for producing an intermediate signal by applying a first equalization method to the received signal (y_k) based on a finite impulse response whose Z transform $(R^S(Z))$, formed by a polynomial of degree W-p in Z^{-1}, has roots which are the W-p roots of the first set; and
- a second equalization stage for producing estimations $(\hat{d}_k)$ of the discrete symbols of a signal carried on the channel by applying a second equalization method to the intermediate signal based on a finite impulse response whose Z transform $(R^I(Z))$, formed by a polynomial of degree p in Z^{-1}, has roots which are the p roots of the second set.

6. A receiver according to claim 5, wherein the first equalization stage is arranged to yield the intermediate signal in the form of a vector Y' of n+p samples $(y'_1, \ldots, y'_{n+p})$ obtained according to the relation :

$$Y' = (A'^H A')^{-1} A'^H Y$$

where n is an integer representing a frame size, Y is a vector composed of n+W samples (y_k) of the received signal, and A' is a matrix with n+W rows and n+p columns

having a Toeplitz structure formed from the coefficients (s_q) of said polynomial of degree W-p in Z^{-1} $(R^S(Z))$.

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7. A receiver according to claim 5 or 6, wherein the second equalization stage is arranged to implement a Viterbi algorithm.

8. A receiver according to any one of claims 5 to 7, wherein the means for distributing the W roots into the first and second sets make use of a unit circle distance criterion expressed as a distance δ_q of the form $\delta_q = 1 - |\alpha_q|$ if $|\alpha_q| \le 1$, and of the form $\delta_q = 1 - 1/|\alpha_q|$ if $|\alpha_q| > 1$, for $1 \le q \le W$.

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